1. Demographic Information

Background
In late 2021 the Ohio Articulation and Transfer Network (OATN) held a discussion with the Physics Transfer Assurance Guide (TAG) panel to review current learning outcomes. With the Physics TAG area learning outcomes last reviewed in 2015, subject matter experts serving on the TAG panel participated in an in-depth review to determine if learning outcomes revisions are recommended.

After some discussion, the TAG faculty panel has recommended revisions to the following Physics TAG courses:

- **OSC014: Algebra-Based Physics I (with lab)**
- **OSC015: Algebra-Based Physics II (with lab)**

Ongoing review is under way, in the areas of OSC016- College Physics I (with lab) and OSC017- College Physics II (with lab). As the Physics TAG panel concludes recommendations a further communication will be sent statewide.

What We Need From You:
The Physics TAG panel seeks feedback from your institutions regarding the proposed revisions. Please arrange to have the appropriate Physics faculty at your institution assist with commenting and completing the survey as soon as possible **but no later than October 17, 2022**. We are collecting only one representative response per institution. Please work within your institution to reach institutional consensus prior to providing feedback. A copy of the proposed TAG course learning outcomes has been attached as reference.

Please provide your institutional response by **October 17, 2022**. The survey link is:
https://www.surveymonkey.com/r/26LZ98D

Important Note: Institutions must complete the survey via the link provided above. The attached PDF file is for reference only. Do not use the PDF version to respond to the survey.

Thank you in advance for your assistance. If you have any questions, contact Jessi Spencer, Senior Director, OATN Policy, Budget, and Constituent Relations, as 614-78-4706 or jspencer@highered.ohio.gov.

* 1. Demographic Information about the Person Completing this Survey

Name	
Institution	
Department	
Title	
Email	
Phone	

* 2. Please Indicate the Type of Institution that you represent

- ◯ Two-Year Institution
- ◯ Four-Year Institution

2. Algebra- Based Physics with Labs I (OSC014)

4-5 Semester Hours

Co-requisites: College Algebra and Pre-calculus.

Related TAGs: Biology, Chemistry, Civil/Construction Engineering Technology, Electrical Engineering Technology, Mechanical Engineering Technology

Required Components include:
I. Experiment
II. Kinematics
III. Dynamics
IV. Conservation Laws
Optional Components include:
V. Oscillations and Waves
VI. Fluids
VII. Heat & Thermodynamics

In order for a course to be approved for OSC0 014- Algebra Based Physics I (with labs), all of the following must be met:
1) All "Required Component" student learning outcomes (SLOs) 1-4 must be met and at least one out of the three "Optional Component" SLO's 5-7 must be met.
2) All student learning outcomes (SLOs) embedded within a "Required Component" area are required to meet the entirety of the required component area. This is also true for the "Optional Component" SLO's. All SLO's embedded within the optional component are required to meet the entirety of the optional component area however, this is only true when an optional component area is selected by an institution.

1. Below are the learning outcomes for Algebra- Based Physics with Labs (OSC014) listed individually. Do you agree with these outcomes?

	Yes- should be required	Yes- should be optional	No
Experiment (Required Component) 1a. Collect data, assess its validity, and interpret its physical meaning for experiments that relate to the topics included in the required learning outcomes in core components 1-4 in OSC 014.	○	○	○
Experiment (Required Component) 1b. Meet the guidelines for the	○	○	○

Natural Sciences Laboratory Requirement for the Ohio Transfer 36, found at the following link here.			
Kinematics (Required Component) 2a. Make accurate verbal, graphical, and mathematical descriptions of translational and rotational motion in one and two dimensions.			
Kinematics (Required Component) 2b. Use algebra and graphical methods to link displacement, velocity, and acceleration.			
Kinematics (Required Component) 2c. Solve 1D kinematic problems with constant linear and angular acceleration.			
Kinematics (Required Component) 2d. Solve 2D projectile motion problems with start and end points at different heights.			
Kinematics (Required Component) 2e. Relate the motion of two objects relative to each other.			
Dynamics (Required Component) 3a. Use Newton's laws of motion (1st, 2nd, and 3rd) to explain or predict the motion of translating and rotating objects.			
Conservation Laws (Required			

Component) 4a. Explain or predict the motion of translating and/or rotating objects using conservation of energy.	○	○	○
Conservation Laws (Required Component) 4b. Explain or predict the motion of translating and/or rotation of objects in 1D using the conservation of momentum.	○	○	○
Conservation Laws (Required Component) 4c. Explain or predict the outcome of collisions.	○	○	○
Conservation Laws (Required Component) 4d. Determine the center of mass of extended objects.	○	○	○
Conservation Laws (Required Component) 4e. Determine the moment of inertia of rigidly connected masses.	○	○	○
Conservation Laws (Required Component) 4f. Use the parallel axis theorem in the solution of problems of extended objects of simple symmetries rotating about an axis that is not through their center of mass.	○	○	○
Oscillations and Waves (Optional Component) 5a. Explain or predict motion of objects in simple harmonic motion.	○	○	○
Oscillations and Waves (Optional Component) 5b. Explain or			

predict mechanical wave phenomena in terms of frequency, wavelength, wave speed, and simple harmonic motion.	○	○	○
Oscillations and Waves (Optional Component) 5c. Use superposition in solving problems with interference of two waves.	○	○	○
Oscillations and Waves (Optional Component) 5d. Describe standing wave patterns and how their confinement determines the wavelength allowed.	○	○	○
Oscillations and Waves (Optional Component) 5e. Describe and predict the addition of two waves of similar but not identical frequency aka the beating of waves.	○	○	○
Oscillations and Waves (Optional Component) 5f. Solve problems where the frequency of a sound detected is affected by the motion of the source and/or the receiver relative to the medium (Doppler Effect).	○	○	○
Fluids (Optional Component) 6a. Describe how the pressure in a fluid varies as a function of depth interns of the pressure relative to the surface of the fluid and the absolute pressure in the fluid.	○	○	○
Fluids (Optional Component) 6b. Predict whether and object will sink	○	○	○

or float in a fluid.			
Fluids (Optional Component) 6c. Predict the variation in velocity and pressure as an incompressible fluid flows though pipes of varying diameter and height.	○	○	○
Fluids (Optional Component) 6d. Predict the apparent weight of objects partially or fully immersed in a fluid.	○	○	○
Fluids (Optional Component) 6e. Explain the physics underlying hydraulic lifts.	○	○	○
Heat & Thermodynamics (Optional Component) 7a. Describe the effect of heat on the properties of materials.	○	○	○
Heat & Thermodynamics (Optional Component) 7b. Describe/predict the transfer of energy between a system and its environment using the first law of thermodynamics.	○	○	○
Heat & Thermodynamics (Optional Component) 7c. Describe an ideal gas in terms of volume, pressure, temperature, and number of moles.	○	○	○
Heat & Thermodynamics (Optional Component) 7d. Relate macroscopic and microscopic properties of matter using the kinetic	○	○	○

theory of gases.			
Heat & Thermodynamics (Optional Component) 7e. Predict the efficiency of a heat engine and its maximum efficiency.	◯	◯	◯
Heat & Thermodynamics (Optional Component) 7f. Describe and predict properties of gases using the ideal gas law.	◯	◯	◯
Heat & Thermodynamics (Optional Component) 7g. Describe properties of phases of matter (solid, liquid, and gas) and their transformations.	◯	◯	◯
Heat & Thermodynamics (Optional Component) 7h. Transfer of heat by conduction, convection, and radiation.	◯	◯	◯
Heat & Thermodynamics (Optional Component) 7i. Distinguish between reversible and irreversible processes.	◯	◯	◯

2. Do you think that your course(s) meet the learning outcomes required?

- ◯ Yes
- ◯ No

3. What fraction of the required learning outcomes do your courses meet?

4. Are there changes to the optional learning outcomes that you would recommend?

5. Are there any learning outcomes that are missing?

6. Do you think that courses approved more than ten years ago should be resubmitted?

- ◯ Yes
- ◯ No

7. Do you agree with the sample tasks?

- ◯ Yes
- ◯ No

If not, please explain.

8. Would you like any additional sample tasks included?

- ◯ Yes
- ◯ No

If yes, please explain.

9. Comments:

3. Algebra- Based Physics with Labs II (OSC015)

4-5 Semester Hours

Co-requisites: College Algebra and Pre-calculus.

Related TAGs: Chemistry, Civil/Construction Engineering Technology, Electrical Engineering Technology, Mechanical Engineering Technology

Required Components include:
I. Experiment
II. Electromagnetism
III. Electrical Devices and Circuits
IV. Geometric and Physical Optics

Optional Components include:
V. Special Relativity
VI. Quantum Physics
VII. Nuclear Physics

In order for a course to be approved for OSC0015- Algebra Based Physics II (with labs), all of the following must be met:

1) All "Required Component" student learning outcomes (SLOs) 1-4 must be met and at least one out of the three "Optional Component" SLO's 5-7 must be met.
2) All student learning outcomes (SLOs) embedded within a "Required Component" area are required to meet the entirety of the required component area. This is also true for the "Optional Component" SLO's. All SLO's embedded within the optional component are required to meet the entirety of the optional component area however, this is only true when an optional component area is selected by an institution.

1. Below are the learning outcomes for Algebra- Based Physics with Labs (OSC015) listed individually. Do you agree with these outcomes?

	Yes- should be required	Yes- should be optional	No
Experiment (Required Component) 1a. Collect data, assess its validity, and interpret its physical meaning for experiments that relate to the topics included in the required learning outcomes in core components 1-4 in OSC 015.	○	○	○
Experiment (Required Component)			

1b. Meet the guidelines for the Natural Sciences Laboratory Requirement for the Ohio Transfer 36, found at the following link here.	○	○	○
Electromagnetism (Required Component) 2a. Describe the motion of charged particles in external electric fields in terms of forces and energy.	○	○	○
Electromagnetism (Required Component) 2b. Describe electric fields and electrostatic potentials produced by simple charge distributions [point charges, charged plates, and parallel-plate capacitors].	○	○	○
Electromagnetism (Required Component) 2c. Relate the electrostatic energy stored in a capacitor to the energy density of the electric field.	○	○	○
Electromagnetism (Required Component) 2d. Relate electric field lines to equipotential lines.	○	○	○
Electromagnetism (Required Component) 2e. Describe the motion of charged particles and current-carrying wire segments in uniform magnetic fields in terms of forces and torques.	○	○	○
Electromagnetism (Required Component) 2f. Describe the magnetic field produced by current-	○	○	○

carrying long thin wires and solenoids.			
Electromagnetism (Required Component) 2g. Describe the motion of charged particles in regions with both electric and magnetic fields.	○	○	○
Electromagnetism (Required Component) 2h. Relate the magnetostatic energy stored in a solenoid to the energy density of the magnetic field.	○	○	○
Electromagnetism (Required Component) 2i. Relate the electric field lines to equipotential lines for simple charge distributions.	○	○	○
Electromagnetism (Required Component) 2j. Describe magnetic field lines for simple situations [wire, bar magnet, and solenoid].	○	○	○
Electrical devices and circuits (Required Component) 3a. Analyze the voltage drops across and charges on capacitors of a circuit of capacitors arranged in series and parallel.	○	○	○
Electrical devices and circuits (Required Component) 3b. Analyze the voltage drops across and currents through resistors of a circuit of resistors arranged in series and parallel.	○	○	○
Electrical devices and circuits (Required			

Component) 3c. Apply Kirchhoff's laws to find currents (in magnitude and direction) of multi-loop circuits with multiple batteries.	○	○	○
Electrical devices and circuits (Required Component) 3d. Describe the powers delivered by batteries and the powers dissipated in resistors in simple circuits.	○	○	○
Electrical devices and circuits (Required Component) 3e. Describe the time-dependence of the voltage and current through a resistor R, capacitor C, and an inductor L.	○	○	○
Geometric and Physical Optics (Required Component) 4a. Describe light as an electromagnetic wave in terms of frequency, wavelength, and speed of light.	○	○	○
Geometric and Physical Optics (Required Component) 4b. Characterize the spectrum of EM waves in terms of frequency and wavelength.	○	○	○
Geometric and Physical Optics (Required Component) 4c. Describe the speed of light in matter in terms of index of refraction.	○	○	○
Geometric and Physical Optics (Required Component) 4d. Describe the	○	○	○

refraction of light at interfaces and relate the angles of incoming and refracted rays in terms of Snells' law.			
Geometric and Physical Optics (Required Component) 4e. Explain the dispersion of light by the frequency dependence of the index of refraction.			
Geometric and Physical Optics (Required Component) 4f. Describe the intensity of EM waves in terms of electric and magnetic energy densities and the speed of light.			
Geometric and Physical Optics (Required Component) 4g. Analyze the image formed by plane and spherical mirrors using ray tracing and the mirror and magnification equations.			
Geometric and Physical Optics (Required Component) 4h. Analyze the image formed by one and two lenses using ray tracing and the lens and magnification equations.			
Geometric and Physical Optics (Required Component) 4i. Relate the interference pattern of a double slit to the separation of slits and wavelength.			
Geometric and Physical Optics			

(Required Component) 4j. Relate the resolving power of a lens to the diffraction of light by an opening.	○	○	○
Special Relativity (Optional Component) 5a. Predict the relative perception of a time interval [time dilation] or the length [Lorentz contraction] of an object for observers in different inertial reference frames using the Lorentz transformations.	○	○	○
Special Relativity (Optional Component) 5b. Apply the relativistic momentum-energy principle to objects moving at a speed close the speed of light.	○	○	○
Quantum Physics (Optional Component) 6a. Differentiate between wave- and particle-like properties of light and relate them to each other.	○	○	○
Quantum Physics (Optional Component) 6b. Describe the production and properties of photoelectrons with the particle-like property of light.	○	○	○
Quantum Physics (Optional Component) 6c. Relate the intensity of light (EM waves) in terms of the number and frequency of photons.	○	○	○
Quantum Physics (Optional			

Component) 6d. Determine if the condition under which wave-like properties of particles are relevant.	○	○	○
Quantum Physics (Optional Component) 6e. Relate the wave-like nature of an electrons in its stationary state to the size of a confining potential [particle in a box].	○	○	○
Quantum Physics (Optional Component) 6f. Relate the outcome of the Rutherford experiment to the atomic model.	○	○	○
Quantum Physics (Optional Component) 6g. Determine the resolving power of an electron microscope with the Heisenberg uncertainty principle.	○	○	○
Quantum Physics (Optional Component) 6h. discuss the scattering of a photon off an electron (Compton effect).	○	○	○
Quantum Physics (Optional Component) 6i. Discuss the spontaneous and stimulated emission of light (photons); explain the basic principle underlying a laser.	○	○	○
Quantum Physics (Optional Component) 6j. discuss qualitatively the quantum-mechanical picture of the	○	○	○

hydrogen atom.			
Nuclear Physics (Optional Component) 7a. Compare the size of atoms and nuclei and the forces between the particles composing them.	◯	◯	◯
Nuclear Physics (Optional Component) 7b. Calculate the binding energy per nucleon from mass-defect of atoms.	◯	◯	◯
Nuclear Physics (Optional Component) 7c. Recognize the variation in nuclear stability at low and high Z.	◯	◯	◯
Nuclear Physics (Optional Component) 7d. Distinguish between fission and fusion in nuclear reactions and explain how energy is “released.”	◯	◯	◯
Nuclear Physics (Optional Component) 7e. Describe the initial and final isotopes involved in alpha, beta, and gamma decay.	◯	◯	◯
Nuclear Physics (Optional Component) 7f. Describe radioactive decay and activity in terms of half-life and initial number of radioactive isotopes.	◯	◯	◯

2. Do you think that your course(s) meet the learning outcomes required?

- ◯ Yes
- ◯ No

3. What fraction of the required learning outcomes do your courses meet?

4. Are there changes to the optional learning outcomes that you would recommend?

5. Are there any learning outcomes that are missing?

6. Do you think that courses approved more than ten years ago should be resubmitted?

- ◯ Yes
- ◯ No

7. Do you agree with the sample tasks?

- ◯ Yes
- ◯ No

If not, please explain.

8. Would you like any additional sample tasks included?

- ◯ Yes
- ◯ No

If yes, please explain.

9. Additional Comments:

4. Survey Completion

Thank you for completing this survey!